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Histopathological effects of intranasal mometasone furoate on adenoidal tissue in children undergoing adenoidectomy

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ABSTRACT

Aims: Adenoidal hypertrophy is a major contributor to upper airway obstruction and sleep-disordered breathing in children. Although intranasal corticosteroids (INCS) are clinically effective in alleviating symptoms, their histopathological effects on adenoidal tissue remain underexplored. This study aimed to evaluate the histopathological changes in adenoidal tissue following preoperative intranasal mometasone furoate therapy in pediatric patients undergoing adenoidectomy.

Methods: This retrospective cross-sectional study included 96 children aged 2–18 years who underwent adenoidectomy between 2022 and 2024. Patients were divided into two groups: group 1 (no steroid therapy) and group 2 (received intranasal mometasone furoate 100 mcg/day for six weeks preoperatively). All patients used saline nasal irrigation during the same period. Adenoidal tissue samples were assessed histopathologically using semi-quantitative scoring (0–3) for follicular hyperplasia, chronic inflammation, acute inflammation, and goblet cell hyperplasia. Binary parameters including fibrosis, atrophy, ulceration, and hemorrhage were also evaluated.

Results: Group 2 exhibited significantly lower levels of follicular hyperplasia (median score 1.0 vs. 3.0, $p<0.001$), acute inflammation (0.0 vs. 1.0, $p<0.001$), and goblet cell hyperplasia ($p=0.048$) compared to group 1. No significant differences were observed in chronic inflammation, fibrosis, atrophy, ulceration, or hemorrhage.

Conclusion: Preoperative intranasal mometasone furoate significantly reduces certain inflammatory and hyperplastic histopathological features of adenoidal tissue in children. These findings support its use as a non-surgical treatment option for selected cases of adenoidal hypertrophy and warrant further prospective research.

Keywords: Adenoid hypertrophy, mometasone furoate, intranasal corticosteroids, histopathology, adenoidectomy

INTRODUCTION

Adenoidal hypertrophy is one of the most common causes of upper airway obstruction in children and plays a central role in the pathogenesis of sleep-disordered breathing (SDB), including obstructive sleep apnea (OSA).[1] The primary anatomical contributors to pediatric OSA are enlarged adenoids and tonsils, with adenoidectomy or adenotonsillectomy widely accepted as the first-line surgical treatment.[1,2]

This immunologically active tissue plays a key role in mucosal defense through antigen presentation and immunoglobulin production, especially during early childhood.[2] However, chronic antigenic stimulation and mucosal inflammation can lead to persistent hypertrophy, disrupting nasal airflow and promoting recurrent infections.[2,3]

In recent years, attention has shifted toward non-surgical alternatives that modulate the inflammatory pathways driving adenoidal hypertrophy. Topical intranasal corticosteroids (INCS), particularly mometasone furoate, have emerged as a promising therapeutic option due to their potent anti-inflammatory and lympholytic effects.[3,4] Clinical studies have shown that INCS can reduce adenoid size, alleviate symptoms of nasal obstruction and SDB, and potentially delay or obviate the need for surgery in selected patients.[3] While their clinical efficacy in symptom control is well established, the precise histopathological changes induced by intranasal steroids within adenoidal lymphoid tissue remain poorly defined.

To address this gap, the present study aims to evaluate the histopathological effects of intranasal mometasone furoate on adenoidal tissue in children undergoing adenoidectomy. By comparing treated and untreated patients across several microscopic parameters—including follicular hyperplasia, inflammatory cell infiltration, goblet cell hyperplasia, fibrosis, and epithelial changes—this study seeks to elucidate the tissue-level impact of topical steroid therapy and contribute to the

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understanding of its therapeutic role in managing adenoidal hypertrophy. We hypothesized that preoperative intranasal mometasone furoate therapy would lead to significant reductions in histopathological indicators of inflammation and hyperplasia in adenoidal tissue.

METHODS

Ethics

This retrospective cross-sectional study was conducted by reviewing the medical records of pediatric patients aged 2 to 18 years who underwent adenoidectomy at a tertiary care otorhinolaryngology department between 2022 and 2024. The study was approved by Hitit University Faculty of Medicine Researches Ethics Committee before data collection (Date: 06.05.2025, Decision No: 2025—80). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Patient Selection

Patients were included in the study if they were between 2 and 18 years of age and had complete histopathological tissue records related to the adenoidectomy. Patients were excluded if they had incomplete medical or histopathological data, had undergone concomitant tonsillectomy, had craniofacial anomalies or syndromic diseases, had a recent history (within the past month) of upper respiratory tract infection and/or antibiotic use, or if otitis media with effusion was detected during surgery.

A total of 96 patients meeting the inclusion criteria were enrolled. Patients were divided into two groups based on their use of intranasal corticosteroid treatment prior to surgery. Group 1 consisted of patients who had not received any nasal steroid treatment, while group 2 included patients who had received mometasone furoate (nasonex; 100 mcg/day) as a nasal spray (50 mcg/puff), administered as two puffs per nostril once daily for six weeks. All patients in both groups performed nasal irrigation with saline during the treatment period.

Histopathological Evaluation

All adenoidal tissue specimens were fixed in formalin, embedded in paraffin, and stained with hematoxylin and eosin (H&E). The slides were evaluated under a light microscope (Nikon Eclipse Ni) by a single pathologist (HHKŞ) who was blinded to the treatment group assignments. Sections of the tissues were examined first at x4 and then at x10, x20 and x40 high magnification fields. Several images were obtained from each stained slide section and photographed to publication quality.

Histopathological evaluation included both semi-quantitative and binary assessments. A semi-quantitative scoring system (0=none, 1=mild, 2=moderate, 3=severe) was employed to assess the severity of follicular hyperplasia, chronic inflammation, acute inflammation, and goblet cell hyperplasia. In addition, the presence or absence of squamous metaplasia, fibrosis, atrophy, ulceration, and hemorrhage was recorded as part of the binary evaluation.

Statistical Analysis

The data analysis was performed using SPSS software version 22.0 (IBM Corp., Armonk, NY). Based on the analysis, a minimum of 45 patients per group was required to detect a moderate effect size (α=0.05, power=0.80). The Mann–Whitney U test was used for comparing ordinal variables between the two groups. Fisher's exact test was applied for binary variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 96 patients were included in the study, with 51 patients in group 1 (no nasal steroid use) and 45 patients in group 2 (nasal steroid use).

Descriptive statistics regarding age and gender distribution are presented in **Table 1**.

Table 1. Demographic characteristics of the study population

Characteristic	Group 1 (n=51)	Group 2 (n=45)
Mean age	7.57±3.13 years	6.47±2.99 years
Female sex	47.1% (24/51)	53.3% (24/45)
Male sex	52.9% (27/51)	46.7% (21/45)

Histopathological evaluation of adenoidal tissue samples revealed statistically significant differences between the groups for several parameters. The median follicular hyperplasia score was significantly higher in group 1 compared to group 2 (3.0 vs. 1.0, p<0.001). Similarly, acute inflammation was more prevalent in the non-steroid group (1.0 vs. 0.0, p<0.001). A significant difference was also observed in goblet cell hyperplasia, despite both groups showing low median scores (0.0 vs. 0.0, p=0.048). The comparison of histopathological parameters between the two groups is presented in **Table 2**. Examples of histopathological differences between the groups are presented in **Figure**.

Table 2. Comparison of histopathological parameters between the two groups

Parameter	Test type	Non-steroid group, group 1 (median)	Steroid group, group 2 (median)	p-value
Follicular hyperplasia	Mann–Whitney U	3.0	1.0	<0.05*
Chronic inflammation	Mann–Whitney U	3.0	3.0	>0.05
Acute inflammation	Mann–Whitney U	1.0	0.0	<0.05*
Goblet cell hyperplasia	Mann–Whitney U	0.0	0.0	<0.05*
Fibrosis	Fisher's exact	37.3%	26.7%	>0.05
Atrophy	Fisher's exact	29.4%	13.3%	>0.05
Ulceration	Fisher's exact	88.2%	86.7%	>0.05
Hemorrhage	Fisher's exact	76.5%	80.0%	>0.05

No statistically significant differences were found between the groups in terms of chronic inflammation (p=0.338), fibrosis (37.3% vs. 26.7%, p=0.284), atrophy (29.4% vs. 13.3%, p=0.183),

ulceration (88.2% vs. 86.7%, p=0.759), or hemorrhage (76.5% vs. 80.0%, p=0.671).

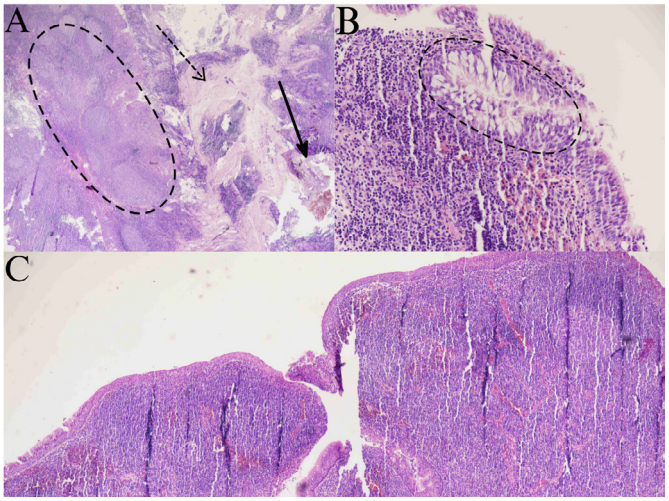

Figure. A. In a sample from the non-steroid group (group 1), follicles of varying diameters are observed, with marked follicular hyperplasia (indicated by dashed circle), fibrosis (indicated by dashed arrow), and hemorrhage (indicated by solid arrow) (H&E, X200). **B.** Prominent goblet cell hyperplasia is observed in a sample from the non-steroid group (group 1) and marked by a dashed circle (H&E, X2000). **C.** In a sample from the steroid-treated group (group 2), no follicular hyperplasia, fibrosis, or goblet cell hyperplasia is observed; minimal hemorrhage and minimal chronic and acute inflammatory cell infiltration are present (H&E, X400)

DISCUSSION

INCS, particularly mometasone furoate, are commonly used in children to suppress inflammatory processes associated with adenoidal hypertrophy. These agents act directly on mucosal lymphoid tissue when applied locally and inhibit cytokine release and cellular proliferation.[1] Previous studies have shown that intranasal steroids are particularly effective in allergic children, leading to symptomatic improvement and potentially reducing the need for surgical intervention.[5] Some studies suggest that allergic status may influence the response to intranasal steroids, although our study did not assess this parameter.[5,6]

Numerous studies have investigated the effects of intranasal steroids on adenoid size. Most have reported statistically significant reductions in adenoid volume following 4 to 8 weeks of topical steroid use, especially with mometasone or fluticasone.[6-8] However, some studies have shown that this effect may diminish over time or with shorter treatment durations. For instance, Zwierz et al.[9] observed no significant changes in adenoid size 3 to 6 months after a 12-week course of mometasone furoate, highlighting the importance of treatment duration and follow-up interval. These findings imply that while topical steroid therapy may be effective in the short term, long-term persistence of these benefits may require regular follow-up and possibly maintenance therapy.

In contrast, only a limited number of studies have evaluated the histopathological effects of intranasal steroids on adenoidal tissue. Ahmed et al.[3] reported that a one-month course of mometasone furoate reduced reactive germinal centers, vascularity, and spongiosis in adenoidal specimens. Similarly, Akcan et al.[4] found significant decreases in follicular hyperplasia, goblet cell hyperplasia, and chronic inflammation in children treated with mometasone furoate, although they also noted increases in fibrosis, atrophy, and ulceration. These findings suggest that intranasal steroids may induce not only size reduction but also structural alterations in the tissue. Likewise, Kheirandish-Gozal et al.[1] showed that corticosteroids inhibited lymphoid cell proliferation and significantly reduced TNF-α, IL-6, and IL-8 levels in adenoidal cell cultures. This supports the hypothesis that the effects of steroids extend beyond macroscopic changes to include cellular and molecular mechanisms.

In our study, patients treated with mometasone furoate had significantly lower levels of follicular hyperplasia and acute inflammation compared to those who did not receive steroid treatment (p<0.001). A statistically significant difference was also observed in goblet cell hyperplasia (p=0.048). These results are consistent with those reported by Akcan[4] and Ahmed.[3] On the other hand, no significant differences were found between the groups regarding fibrosis, atrophy, ulceration, or hemorrhage, which may be related to the duration of steroid exposure or individual variation in tissue response. Similar to prior studies, chronic inflammation scores remained high in both groups without a significant difference.[4]

Interestingly, some studies have reported greater histological and clinical improvements when antileukotriene agents such as montelukast are used in combination with topical steroids. Ras et al.[10] found that patients receiving combined therapy had better symptom scores, greater reduction in adenoid size, and lower recurrence rates compared to those treated with steroids alone. In addition, Ezzat et al.[11] demonstrated that postoperative intranasal steroid use significantly reduced the recurrence of adenoidal hypertrophy and related symptoms. These findings suggest that steroids may be beneficial not only in the preoperative but also in the postoperative setting. These findings highlight the potential of combination or extended treatment strategies, which warrant further investigation through long-term studies.

Limitations

This study has several limitations. First, the retrospective design limited our ability to verify patient compliance with intranasal steroid therapy, as adherence was assessed only through patient records and self-reporting. Additionally, histopathological evaluation was performed by a single pathologist in a single-blinded manner, which may introduce potential bias due to subjective interpretation. Another notable limitation is the lack of differentiation between patients with and without allergic rhinitis. Given that previous research suggests allergic patients may respond more strongly to steroid treatment, the absence of allergy status data may limit the generalizability of our findings. Future studies should stratify patients by allergic status to better understand differential histopathological responses to intranasal steroids. Finally, the sample size was relatively small, and larger, prospective, controlled studies are needed to validate our results. Future research should also consider stratifying patients based on allergic status to better understand the histopathological effects of intranasal steroids.

CONCLUSION

As a result, our study demonstrates that intranasal mometasone furoate significantly reduces follicular hyperplasia, goblet cell hyperplasia, and acute inflammation in adenoidal tissue. These findings indicate that topical steroids may exert beneficial effects not only on symptom control but also at the histopathological level. Based on these results, INCS may represent an effective non-surgical treatment option, particularly in patients with mild to moderate symptoms for whom surgery may be avoided. However, these findings should be supported by larger, prospective, long-term studies.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was approved by Hitit University Faculty of Medicine Researches Ethics Committee before data collection (Date: 06.05.2025, Decision No: 2025—80).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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